

Vital Support of Information Technology in India during Novel Coronavirus Disease 2019

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ABSTRACT

The group of patients on December 2019 in Wuhan, Hubei Province, China was struck by fever and littleness of breath. In January 7, 2020, the cause of the outbreak is recognized as severe serious respiratory syndrome coronavirus 2 (SARS-CoV-2) and is isolated by the Chinese authorities. As of April 04, 2022, total 489,779,062 established cases of coronavirus disease of 2019 was 489,779,062.

COVID-19 spreads as soon as an infected individual exhales virus-containing droplets and other persons breathe in these droplets, or they may deposit on their different body part like eyes, noses, mouth and noses. To prevent its spread, various restrictions have been imposed which in turn has increased the use of technology in various sectors like education, healthcare, etc.

This paper aims to shed some light on the growth, advantages and disadvantages of technology as seen during the pandemic and is an in-depth analysis of growth of online grocery & medicine delivery services, online payment methods like UPI and how education, finance and health industry has been revolutionized in this time period.

Keywords: SARS-COV 2; Technology; Online education; Genomic surveillance/sequencing; Financial sector; Drones and robots.

1. Introduction

Coronavirus disease of 2019 is a recently identified virus-caused transmittable disease. The outbreak of Coronavirus was proclaimed a Worldwide Public Health crisis on last week of January 2020 by World Health Organization. WHO categorized COVID-19 as a pandemic disease by second week of March 2020 [1]. The World Health Organization (WHO) recorded 44,768,172 verified cases and 531,000 deaths in India at the time this manuscript was prepared on 12 April 2023 [2]. Globally, the number of confirmed cases 685,297,585 in more than 230 countries as of this writing (April 12, 2023) [3]. The nation of 1.3 billion people, India is in lockdown since 25th March 2020 and is only connected through the world and its surroundings by technology and the world and its surroundings by technology and the internet to slow down the spread of COVID-19. Home-essentials were being delivered at doorsteps, Law-Enforcement Officials were working day and light for helping those in need and maintaining the Lockdown restrictions. Employees are working from home to prevent the economy from crashing completely along with maintaining the idea of social distancing. In this house-arrest situation, technologies and applications that are being used by the people of India and implementations that can be made are discussed in this paper. On the other hand, the Government of India and Many Multi-National Companies are working towards helping people in this situation through their services in different ways which are also discussed in this paper.

2. Role of Technology in Education

A. The Situation

According to the recent UNICEF data, schools completely closed for 168 million kids all over world for a year because of COVID-19. Furthermore, approximately 214 million children globally lost nearly three-quarters of face-to-face learning [4].

According to the school closure report analysis, 14 countries all over world remained closed from March 2020 to February 2021. 2/3 of the countries, affecting nearly 98 million schoolchildren, are in South and Central America, as well as the Caribbean. Out of the 14 countries, Panama country had the maximum school closures, tracked by some other country like Bolivia, El Salvador, and Bangladesh [4].

Before the emergence of COVID-19, most schools and colleges did not focus on investing in technology for the purpose of teaching and learning, they were not much different from the education architecture from 19th and 20th century.

B. Online Classes

When COVID-19 forced campuses to close two years back, some institutions were capable to redirect their students to previously robust online education Programmes. However, many other institutions scrambled to create their own online education curricula. Students and faculty are frequently found for the first-time logging into Zoom or other online platforms [5], with less knowledge of how to work in a new world of virtual learning.

The pandemic forced the academic institutions to bring out a new way of teaching and learning remotely with the help of technology, it brought the concept of online classes to motion.

An Online Class can shaped through use of a LMS [6] which allows students and educator to meet either synchronously (real-time meeting) or asynchronously (meeting teacher and students occurring occasionally with a time lag).

C. Advantages

a. Ease of Access

The most important advantage of taking of an online learning is that it can be accessed from anywhere in the globe. Students have complete control over all issues. You have the freedom to access declarations, study material, examine assignments, practice tests, address questions, interact with other students, and examine whenever you want [7],[8]. Apart from a few time constraints, you can set a personal schedule for finishing the requirements for the credits [9].

b. Resource Saving

Another major benefit of online classes is that the lectures and course materials may be saved for later use, and even if a student is unable to attend the online classes for any reason, the video of that lecture will still be available to watch any time and could even be watched for revisions.

c. Efficiency

Online education provides teachers with an effective means to offer knowledge to students. It includes a variety of resources such as clips, PDF files, and podcasts as well as which teachers may utilize as part of their curriculum. Teachers can become more efficient educators by expanding the lesson plan beyond traditional textbooks to include online resources [7]. Online education gives educators an additional resourceful individual to clarify lessons to learners; there are a variety of resources available, such as clips, PDF files, and audio podcasts, and

teachers may integrate all of these tools into their curriculum. Teachers turn more efficient instructors after incorporating online resources into their lesson plans.

D. Disadvantages

a. Technical Issues [10]

Internet access is another major issue with online classes. While internet coverage has increased dramatically in recent years, maintaining a stable connection with adequate speed remains a challenge in smaller cities and villages. There might be a loss of continuity in learning for children if they do not have access to the internet on a regular basis. This has a negative impact on learning.

b. Unfamiliar with latest technologies [11]

People must have a basic grasp of how to use digital modes of learning in order to teach online. However, this is not always the case. Teachers may have just a rudimentary knowledge of technology. They don't always have the resources and tools they need to offer online classes. To overcome this, schools should invest in providing instructors with the most up-to-date technical training so that they can easily conduct their online lessons.

c. Increased Screen Time and Health Issues

Many parents are concerned about the health risks of their children looking at a screen for long periods of time. One of the most serious problems and downsides of online learning is the rise in screen time.

Students may acquire terrible posture and other physical issues as a result of sitting crouched in front of a screen for long periods of time. Even longer screen time can cause physical problems like Migraine Headaches, Vision Problems, Eye Strains etc.

d. Growth of E-Content and E-Content Creators

The state's higher education agency has mandated that all college professors provide e-content for the current semester, mostly in the form of video lectures, and should be connected to their performance grading. Previously, Although only a small number of educators were requested to create electronic materials, the department has now made it essential for every educator to record video lectures, given the current pandemic's postponement of resuming personally education. Not just Education Agencies, but the need for e-content spawned lots of new online content creators on platforms like YouTube, Udemy, and others, and became a point of success for firms like BYJU's, Unacademy, and others in the field of online education. It made accessing the course material much easier for the students than ever before, in just a few clicks you can watch a lot of video lectures on a specific topic [12].

e. The E-Labs [13]

A major issue that came to picture was that the students were unable to perform experiments from their respective courses- while sitting at home, some of the reasons being unavailability of equipment, expensive and large equipment etc. Thus, the concept of E-Labs came to fulfill that issue. An online environment that brings jointly data, methods for research, analytical tools, sources, and people at the point of examination or making decisions is known as an e-Lab. It helps to perform experiments remotely from your local computer system, all you need is Internet Connection. You can perform experiments in E-labs as if you were performing in the real labs.

3. Role of Technology in the Medical Sector

A. Genomic Sequencing and Genomic Surveillance [14,15]

SARS-CoV-2 has brought ‘pandemics’ to the center of the World’s attention. It has impacted almost every aspect of our lives, but it’s not the first time the world has seen a Pandemic.

In the past, pandemics have occurred due to several diseases like Cholera, Smallpox, Plague, Influenza which never ended but instead started mutating. Technology has helped us to find these variants and mutations and recently it has enabled us to discover the variants of SARS-CoV-2 [14].

Viruses evolve and transform as they circulate from person to person over time. Variants are viruses that have undergone significant changes from the original virus. Scientists identify variants by gene mapping of viruses (a process known as sequencing) and then looking for differences between these individuals to see if they have undergone modifications. Different versions of the SARS-CoV-2 virus, which causes COVID-19, have arisen and been discovered in many countries around globe since the virus's global spread.



Figure 1. Genomic Sequencing [16]



Figure 2. Genomic Surveillance [17]

From the onset of the pandemic, Genomic Surveillance and Sequencing has been at the forefronts of the Pandemic [18]. Genomic Surveillance has helped us find out the variants of concern [19]. Detecting problematic variants and creating a healthcare response to them necessitates an effective genomic monitoring programme [2]. Scientists will sequence virus specimens from approximately 5% of the overall number of COVID-19 patients, chosen to be indicative of the populations the greatest at risk from the infection. Without this genetic knowledge, new variants could spread rapidly and unnoticed across the country and around the world.

India was the 5th country in the world to sequence the viral genome (isolated from the first patients in Kerala) for inclusion in GISAID [18-20]. Indian scientists utilized ARTIC procedure-based tiling amplicon DNA sequencing of SARS-CoV-2 from various states of India, along with MinION and MinIT arranging from Oxford Nanopore Innovation, to determine how SARS-CoV-2 was introduced and spread locally [19-21].

B. At-Home Tests

When tests became more widely available, they generally became available through hospitals, medical clinics, community pharmacies, or state-sponsored amenities. However, this needed patients to depart for the safety of their residence isolations to be tested, which could expose them to unnecessary risk. Testing centers frequently had lengthy queues, were difficult to find, had prolonged waits, and were difficult to schedule appointments. These barriers are unsuitable for those who are at risk, particularly those with limited mobility.



Figure 3. At-Home Test [22]

Then there were "At-Home pick-ups." At-home collection entails collecting a specimen away from a medical facility and then shipping or sending it off at an approved place to be tested in a CLIA-certified high-complexity the lab [23]. Since the beginning of the pandemic, the FDA has issued more than 50 authorizations for personal collection, all of which involve nucleic-acid amplification tests (NAATs), such as RT-PCR [24].

4. Introduction to Drones

Unmanned aerial vehicles (UAVs) and micro air vehicles (MAVs), also known as "drones," have an opportunity to develop into an iconic technology of the twenty-first century. They provide access to (new) spaces and enable their evaluation using novel methods for gathering data. A drone is an air machines that does not have a human pilot [25] on the plane. It depends on the use of cutting-edge computers, high-resolution cameras, powerful electronic regulating systems, broad remote radio-control receiving systems, and lightweight materials such as plastic and fibers of carbon to construct big and light drones, as well as powerful GPS and control remote-systems. These abilities, which were previously restricted to the military, are now increasingly being integrated into civil areas. As a result, drones have a wide range of potential applications, from surveillance/sensing tasks to unique forms of logistics and passenger transport [26].

There are several ways to conduct drone flights:

- A human operator regulates it remotely
- On-board computers operate autonomously.
- Driven by an autonomous robot

A. Context and Purpose of this Note

There have been stated attempts to use drone innovations in different situations in the context of the worldwide pandemic of COVID-19. This brief note analyses publicly accessible data on the usage of drones in response to COVID-19 and shares some thoughts on whether and how drones might be useful in the given situation of a pandemic.

B. Utilization of Drones

a. Transportation of lab-sample, delivery parcels and medical supplies

Based on our survey results, 66.8% of the participants were unable to order from the E-Commerce site during the first week of lockdown [27]. This happened because of the operational constraints and low workforce in companies

like Amazon, Big-Basket, etc. In such a situation, Drones can be used for delivery and supply of medications, home supplies, parcels, food and other products in severely impacted regions and in such situations. They can also minimize time and improve the supply pace. Some carried out it as part of trials and investigations, while others continued with their conventional drone delivery operations. Sub-Saharan African countries such as Rwanda, Ghana [28], and Malawi have documented the use of drones for shipment. They used drones by one of the largest drones selling company 'Zipline'. Zipline CEO Keller Renaud stated in a June 2021 conversation that the company supplied at least 2.6 million COVID-19 vaccine doses in Ghana. The company intended to deliver an additional 2.4 million vehicles, with a particular emphasis on distant and roadless regions.

The Benefits of drones in context of Covid-19 are speedy delivery, extended transportation network and limited physical contact as an outcome of which limited the transmission of covid-19.

b. Areal-spraying to disinfect contamination places

People who require precautions to avoid being infected with viruses and bacteria can benefit from the use of drones. Disinfectants can be sprinkled in areas that are infected by using drones. Countries like China, UAE, Spain, South Korea attempted to use drones as a disinfectant. However, scientific evidence suggests that this application has little to no evidence for efficiency and effectiveness [27].

c. Public surveillance and guidance during lockdown and quarantine

Aside from hobbyist photography, drones with cameras as payloads are primarily utilized for surveillance. They're great for crowd surveillance because they can quickly provide a bird's eye or aerial picture of the current place. That is why, especially during the COVID-19 outbreak, numerous countries throughout the world are utilizing drones for crowd surveillance. Surveillance drones added with temperature sensor can updated about body temperature of peoples in any community area. Sierra Leone, Rwanda, China, United States, Spain, Italy, France, UK, India across the world have deployed drones for surveillance in public spaces by gaining a better situational awareness by an aerial view and enforce quarantine by sending messages over a loudspeaker [27].



Figure 4. Modern drone [29]

5. Role of Robots

A. Introduction to Robots

The global medical robots' market is estimated to be valued over US\$ 35.2 Billion by 2030. It is anticipated to grow at a 21.3% CAGR from 2022 to 2030 [30].

North America, Europe, Asia Pacific, and the Rest of the World make up the worldwide medical robots' market (ROW). The market for medical robots was dominated by North America, followed by Europe and Asia Pacific.

In the medical industry, robots undertake a variety of tasks, including specialized human treatment and surgery. This technology can assist a faraway area in filling doctor and healthcare staff shortages.

It can also help a surgeon do a difficult procedure. Robots can be programmed to carry out the desired task, and this technology can be used to carry out tasks that are dangerous for people.

B. Usability of Robots during covid-19

Robots are intelligent machines that have shown to be useful amid the COVID-19 pandemic and they are introduced in the pandemic to help doctors for the better treatment of supply to the infected patient Robots, because there is less risk of contagious disease spreading from patients who are suffering, robots can readily be deployed as frontline warriors in medical facilities.

Robots equipped with Ultra-Violet (UV) light can be used in hospitals. These Robots can disinfect not only hospital rooms and surgical theatres, but they also disinfect just about everything that you aim at them.

Countries all over the world have taken the advantage from robot technology in the following ways-

1. Social and emotional support

During the pandemic the patients infected with SARs COV 2 had to be totally isolated to prevent the spread of the deadly and highly contagious virus, during this isolation the patients were left alone and there was on one they could talk to, in these times robots placed a very vital role to interact and serve the patients, they interacted with the patients to keep them from falling form depression. The robots were controlled by doctors to keep a check on the patients.

2. Delivery of goods

Robots were deployed during Covid-19 c to deliver medicines, medical equipment, and serving food in medical units to avoid contact with patients directly, hence giving relief to medical staff. Asimov Robotics, a Kerala-based Indian business, has built a three-wheeled robot that can execute all these activities while supporting patients in isolation wards.

3. Monitoring Purposes

Some of the Robots were designed with cameras installed in it to help the forces to keep a check on the public to verify if the social distancing norms are being followed or not. The robots were installed with speakers to follow up the public about preventive measures.

4. Disinfecting the surface

Robots are safer as disinfecting equipment as they will not be infected by the deadly virus. The Robots use UV light radiations to disinfect the surfaces. The UV rays tear apart strands of virus' DNA, hence making it harmless. Companies like UVD have delivered its robots in China, Europe, and United States for the same purpose.

5. Medical procedures

COVID-19's contagious characteristics put numerous medical professionals at danger while performing routine procedures and surgeries. The dentist, oncologist, and ENT surgeons stand in front of the risk zone since the virus spreads rapidly through the mouth and droplets. Long before the pandemic crisis, robotic procedures were successfully performed in a variety of medical sectors, and robots took the responsibility of the surgeries in those times and performed complex surgeries along with the doctors. This reduced the chances of the doctors get infected [31].

6. Role of Technology in the Financial Sector

The financial sector has been no exception to the effects of SARS-CoV-2, be it adverse or propitious. At the start of the outbreak, the financial sector was hit hard with the BSE SENSEX crashes over 2,400 points; Nifty below 10,350. The Covid-19 virus has infected more than 100,000 people across the globe and took 3800 lives so far (As of Mar 23, 2020).

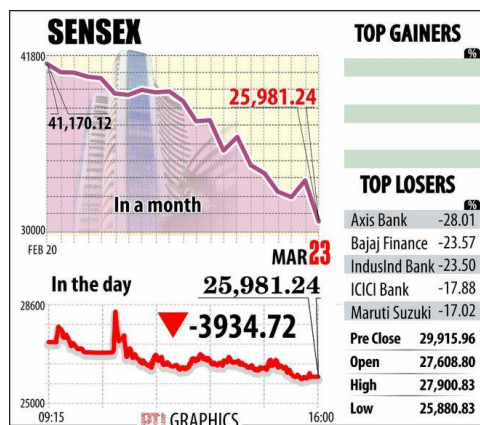


Figure 5. Covid triggers worst market crash [32]

The various restrictions imposed by the countries across the globe led to delays in travel, shipment, etc., caused the market to dip. After a while when the people started to adjust to the lockdown, the market started stabilizing again and saw an uprising in new technologies and startups to ease the gap caused by the restrictions. The pandemic also shined light on pre-existing technologies and services like Zoom Cloud Meetings, Practo, blinkit (Formerly Grofers India Pvt. Ltd.), etc. which saw an exponential growth during the pandemic. On the other hand, small businesses which were about to start or just started around the pandemic, lost a lot of their money and their customers.

Service sectors like insurance, banking, and transport are utilizing these technologies efficiently in collecting, processing, and exchanging data immediately and automatically [33].

The whole model of banking has shifted towards a connected and digital-driven organization. The new digital trends promoting several banking functions like risk management, transactional model, customized service, and information system [34].

The Indian banking sector is discovering a new path in which Artificial Intelligence can be incorporated and as a result, it is going to improve their working efficiency and customer satisfaction [35].

As per survey [36], the global use of Artificial Intelligence in finance is predicted to reach \$22.6B in 2025, with a compound annual growth of 23.37 % during 2020-2025.

A survey was conducted by [37] and found that customers have been using online services considerably in large numbers. The survey also examined (Figure 6) that there is an increase in first- time users of online banking services during pandemic and top of that most of them found satisfactory.

According to the RFI group, almost 71 percent of customers are using digital banking platforms globally. Moreover, there is a sharp rise in mobile banking use monthly from 52 - 57 percent of people between 2019-2020, which is indicating that COVID-19 has accelerated the digital ecosystem [38].

Fig.6 showing that the Banking and Financial sectors following IT and Technology industry and contributing \$615.3 million in market value and 9.6% in market share [39].

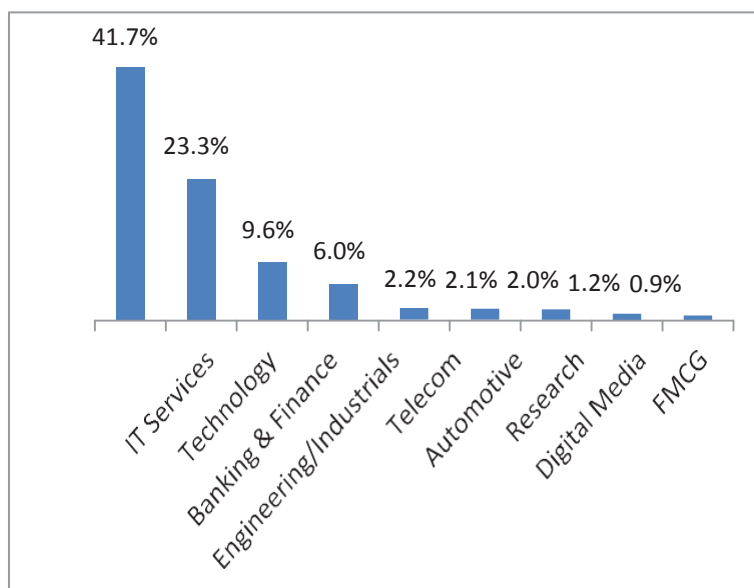


Figure 6. Industry-wise market share of Information Technology [39]

7. Conclusion and Future Recommendations

The present pandemic has had a significant impact on all aspects of our lives. It has shifted people's perspectives on various topics. The entire world is looking for the greatest alternatives to the current technology solutions. All the technologies discussed in this report are aimed towards minimizing, mitigating, and reversing disease spread.

Technology has completely revolutionized education during COVID and has given rise to various technologies which have a place outside the pandemic too. The healthcare sector received a revamp due to the restrictions and pressure it had and has in turn brought Telemedicine and medicine delivery services into the limelight. Moreover, the utilization of robots in the field has also been a big boon for the industry. The growth during pandemic has been exponential and the advantages will continue for years to come.

In the future, digital skills such as coding, data analysis, and machine learning will be prioritized. IT professionals in India with these skills will be in high demand. Not only has information technology aided the country's economic prosperity, but it has also made governance more competent and approachable.

Declarations

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This study did not receive any grant from funding agencies in the public or not-for-profit sectors.

Competing Interests Statement

Authors have declared no competing interests.

Consent for Publication

The authors declare that they consented to the publication of this study.

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